REMARKS/ARGUMENTS

Claims 1-34 were previously pending in the application. Claims 1-34 are canceled, and new claims 35-62 are added herein. Support for new claims 35-62 is found, for example, in Figs. 6A-B and the corresponding text in the specification. Assuming the entry of this amendment, claims 35-62 are now pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

Amended Title of the Invention

In paragraph 1 of the office action, the Examiner stated that the title of the invention is not descriptive. In response, the Applicant has amended the title of the invention to indicate clearly the invention to which the claims are directed.

Digital Pixels

In paragraph 2, the Examiner objected to the drawings under 37 CFR 1.83(a). In paragraph 4, the Examiner rejected claims 13-34 under 35 USC 112, first paragraph. Since the pending claims do not recite "at least one digital pixel" having "a photoelement ... configured to generate a digital electrical signal" the Applicant submits that the Examiner's objection to the drawings and rejections of claims under 112, first paragraph, are now moot.

Further regarding the Examiner's rejections of claims under 112, first paragraph, the Applicant notes that, in paragraph 4, the Examiner stated that "Applicant does not describe or show how to make and use a photoelement that is configured to generate a digital signal." As such, the Examiner concluded that claims 13-34 contained "subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Yet, on pages 6 and 7, the Examiner twice stated that "digital pixels are well known" and that "it would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide a digital pixel and image sensor." The Examiner cannot have it both ways.

In any case, the Applicant explicitly submits that the invention as currently claimed covers both analog and digital pixel implementations.

Prior Art Rejections

In paragraph 6, the Examiner rejected claims 1-3 and 7-9 under 35 U.S.C. 102(b) as being anticipated by Tani. In paragraph 7, the Examiner rejected claims 1, 3-4, 6-7, 9-10, and 12 under 102(b) as being anticipated by Sasaki. In paragraph 8, the Examiner rejected claims 1 and 7 under 102(b) as being anticipated by Koyama. In paragraph 10, the Examiner rejected claims 13, 17-18, 20-24, 28-29, and 31-34 under 35 U.S.C. 103(a) as being unpatentable over Sasaki. In paragraph 11, the Examiner rejected claims 13-18 and 24-29 under 103(a) as being unpatentable over Saitoh. In paragraph 12, the Examiner rejected claims 19 and 30 under 103(a) as being unpatentable over Sasaki in view of Koyama. In paragraph 13, the Examiner rejected claims 5 and 11 under 103(a) as being unpatentable over Koyama. For the following reasons, the Applicant submits that all of the now-pending claims are allowable over the cited references.

New claim 35 is directed to an integrated circuit having an image sensor, wherein the image sensor has an array of one or more pixels. At least one pixel in the array comprises (a) a photoelement

formed on a substrate and configured to generate an electrical signal in response to incident light; (b) associated circuitry formed on the substrate and configured to process the electrical signal generated in the photoelement; and (c) two or more insulator structures formed on the substrate and configured to inhibit flow of electricity between at least one of (1) the photoelement and the associated circuitry and (2) the pixel and an adjacent pixel in the array. The two or more insulator structures comprise (i) an insulator layer between the substrate and at least one of (1) the photoelement and (2) the associated circuitry; and (ii) at least one lateral insulator structure between at least one of (1) the photoelement and the associated circuitry and (2) the pixel and the adjacent pixel. The at least one lateral insulator structure is in direct physical contact with the insulator layer to form a contiguous electrical isolation barrier.

Figs. 6A-B shows an example of the subject matter covered by claim 35. In particular:

- Pixel **602** is an example of the at least one pixel of claim 35;
- Photoelement **604** is an example of the photoelement of claim 35;
- Substrate **630** is an example of the substrate of claim 35;
- Associated circuitry **606** is an example of the associated circuitry of claim 35;
- Oxide layer **632** is an example of the insulator layer of claim 35; and
- Lateral structures **636** and **638** are examples of the at least one lateral insulator structure of claim 35.

As depicted in Fig. 6B and as described in the corresponding text in the specification, lateral structure **636** is between pixel **602** and an adjacent pixel in the array, and lateral structures **638** are between photoelement **604** and associated circuitry **606**. Furthermore, lateral structures **636** and **638** are in direct physical contact with oxide layer **632** to form a contiguous electrical isolation barrier. In particular, lateral structure **636** directly contacts oxide layer **632** to form a contiguous electrical isolation barrier that inhibits the flow of electricity between pixel **602** and the adjacent pixel. Analogously, lateral structures **638** directly contact oxide layer **632** to form a contiguous electrical isolation barrier that inhibits the flow of electricity between photoelement **604** and associated circuitry **606**.

The cited references do not teach or even suggest the combination of features recited in claim 35. In particular, the cited references do not teach a plurality of insulator structures that includes an insulator layer between (a) the substrate and (b) the photoelement and/or the associated circuitry, where the insulator layer is in direct physical contact with one or more lateral insulator structures between either (1) the photoelement and the associated circuitry or (2) the pixel and an adjacent pixel.

The only cited reference that teaches an insulator layer between the substrate and at least one of (a) the photoelement and (b) the associated circuitry is Saitoh. But Saitoh does <u>not</u> teach at least one lateral insulator structure between at least one of (1) the photoelement and the associated circuitry and (2) the pixel and the adjacent pixel, wherein the at least one lateral insulator structure is in direct physical contact with the insulator layer to form a contiguous electrical isolation barrier.

In rejecting original claims 16 and 27 in paragraph 11, and citing Fig. 14, the Examiner stated that Saitoh discloses "one or more insulating structures (11401, 11404) formed on the substrate" where "the insulating structures (11404) comprise a lateral insulating structure between the photoelement and the associated circuitry or between the pixel and the adjacent pixel in the array." The Applicant respectfully submits that the Examiner mischaracterized the teachings of Saitoh in rejecting these claims.

Saitoh teaches a semiconductor detector for detecting light and radiation. Fig. 14 shows a section view of a particular embodiment of Saitoh's semiconductor detector. According to the specification, "**11403** indicates an SOI support substrate, **11404** indicates an SOI-Si layer, **11401** indicates an insulating layer between the SOI support substrate and the SOI-Si layer." See column 14,

lines 7-9. SOI support substrate **11403** may be said to be an example of the substrate the present invention, and insulating layer **11401** may be said to be an example of the insulator layer of the present invention. However, the Applicant submits that SOI-Si layer **11404** is not an example of the at least one lateral insulator structure of claim 35.

First of all, SOI-Si layer **11404** is not an insulator structure. Rather, SOI-Si layer **11404** is made of silicon, which is a semiconductor, not an insulator. See column 14, lines 16-18, which teaches that "Over the [insulating film layer **11401**] there is formed an Si layer." Saitoh explicitly teaches that "The SOI-Si layer 11404 is formed to have a specific resistance of 1 k·Ωcm." See column 14, lines 19-20. Thus, SOI-Si layer **11404** simply cannot be an example of the at least one lateral insulator structure of claim 35.

Furthermore, label **11404** in Fig. 14 does not refer to particular structure located (1) between a photoelement and its associated circuitry or (2) between a pixel and its adjacent pixel. Rather, label **11404** refers to the entire SOI-Si layer within which the photoelements and the associated circuitries of different pixels are formed. See, e.g., label **11421** in Fig. 14, which refers to the thickness of the SOI-Si layer as explained in column 14, lines 19-20. See, also, column 14, lines 21-24, which discloses that the detection part **11405** (i.e., a photoelement) and the CMOS part **11411** (i.e., associated circuitry) are both formed on SOI-Si layer **11404**.

Presumably, the lateral portion of SOI-Si layer **11404** labeled on the left side of Fig. 14 between deep N^- well **11402** and detection part **11410** corresponds to an undoped region of the original SOI-Si layer material and is therefore made of silicon having a specific resistance of 1 k·Ωcm. As such, even that lateral portion of SOI-Si layer **11404** cannot be an example of the at least one lateral insulator structure of claim 35.

Moreover, that lateral portion of SOI-Si layer **11404** is not in direct physical contact with insulating layer **11401**. Rather, the two structures are separated by N^+ type layer **11420**, which is itself not an insulator structure. As such, that lateral portion of SOI-Si layer **11404** and insulating layer **11401** do not form an example of the contiguous electrical isolation barrier of claim 35..

For all these reasons, the Applicant submits that new claim 35 is allowable over the cited references. For similar reasons, the Applicant submits that new claim 49 is allowable over the cited references. Since the rest of the pending claims depend variously from claims 35 and 49, it is further submitted that those claims are also allowable over the cited references. The Applicant submits therefore that the rejections of claims under Sections 102(b) and 103(a) have been overcome.

In view of the above amendments and remarks, the Applicant believes that the now-pending claims are in condition for allowance. Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,

Date: 7/23/03

Steve Mendelsohn

Customer No. 22186
Mendelsohn & Associates, P.C.
1515 Market Street, Suite 715
Philadelphia, Pennsylvania 19102

Steve Mendelsohn
Registration No. 35,951
Attorney for Applicant
(215) 557-6657 (phone)
(215) 557-8477 (fax)